The steel wire used as kite line by the writer is 0.0285 of an inch in diameter and weighs 2.155 pounds per 1,000 feet. The table below gives the pull and the amount of line required to reach certain elevations, depending upon the inclination θ, at which the kite pulls the wire and also the angle θ', to which the wire is permitted to sag at the reel. The wind effect on the wire is neglected, and necessarily so from our present ignorance of the numerical magnitude of these effects. The results are, therefore, not exactly representative of actual kite ascensions. The discrepancies will be small in moderate winds, that is, under 20 miles per hour, but become more important at this and higher velocities.

Essential elements in kite ascension.

$$w = 2.155 \text{ lbs. per } 1{,}000 \text{ ft.}$$

$$t = \frac{wh}{1 - \frac{\cos \theta}{\cos \theta'}} \qquad l = \frac{t}{w} (\sin \theta - \cos \theta \tan \theta')$$

h.	θ'	$\theta=50°$		$\theta=60°$		$\theta=70°$	
		l	t	l	t	l	t
Feet.		*Feet.*	*Pounds.*	*Feet.*	*Pounds.*	*Feet.*	*Pounds.*
2,000	$\theta'=10°$	3,756	12.4	3,162	8.8	2,693	6.6
	$\theta'=20°$	3,367	13.6	2,926	9.2	2,565	6.8
4,000	$\theta'=10°$	7.511	24.8	6,324	17.5	5,386	13.2
	$\theta'=20°$	6,739	27.3	5,853	18.4	5,130	13.6
6,000	$\theta'=10°$	11,267	37.2	9,485	26.3	8,080	19.8
	$\theta'=20°$	10,102	40.9	8,779	27.6	7,694	20.3
8,000	$\theta'=10°$	15,022	49.6	12,647	35.0	10,773	26.4
	$\theta'=20°$	13,469	54.6	11,706	36.8	10,259	27.1
10,000	$\theta'=10°$	18,778	62.0	15,809	43.8	13,466	33.0
	$\theta'=20°$	16,836	68.2	14,632	46.1	12,824	33.9

It is asked "What is the difference in effect between the kite string and the attraction of gravity on the mass of a soaring bird?"

The effects are very different in many respects. In the first place the string constrains its kite to move in a certain definite surface of constraint which, in general, is sensibly a spherical surface. Gravity does not exercise any similar constraint upon the bird. Secondly, the tension or pull of the string may act in many different directions, and with a magnitude which depends almost entirely upon the pressure of the wind upon the kite; that is, if the wind suddenly stops blowing, the string will quite as suddenly slacken up entirely and the feeble pull it exerts due to its direct weight will be in a new direction, and will often be but a small fraction of its original pull. The tension in the string is not a *primary* but a dependent force. The force of gravity on the bird is, however, a primary force, is always constant in amount, and its direction of action is always vertical. We do not consider that there is any real mechanical analogy between the effects of the force of gravity on a bird and the pull of the string of a kite. Without the restraint of the string the kite and the bird are similar in that both are subject to the attraction of gravity, and both expose certain surfaces to the action of the wind. The kite completely lacks the intelligence or instinct of the bird, but stable forms of tailless kites cast adrift in the wind are carried long distances before reaching the ground. Two large Hargrave kites broke away from the writer in a violent rainstorm when at a height of about 7,000 feet. The total supporting surface was about 80 square feet, and the weight 8 pounds plus the effects of rain and several pounds of wire. These kites drifted 15 miles before reaching the ground and descended entirely uninjured.

NOTES BY THE EDITOR.

SEASONAL FORECASTS FOR OREGON.

On the morning weather map of April 12, published at Portland, Oreg., Mr. B. S. Pague, Local Forecast Official, says:

The first summer type of weather conditions appeared Saturday night and Sunday and continues this morning. The appearance of this type marks the commencement of the summer or dry season and the passage of the winter or wet season. From now on until the first appearance of the winter conditions next autumn, fair weather is more probable than rainy weather. Summer conditions do not mean absolute dryness, but rather fewer rainy periods, more sunshine, and more warmth.

In 1895, the first appearance of summer conditions appeared on April 20; rain fell in that year from April 30 to May 9 in showers, and again from May 20 to May 30, the total being 3.42 inches. June had rain on two days. May was cool, and June had normal temperatures.

In 1896, summer conditions did not appear until June 13, and then, except a few sprinkles, no rain fell until August 1, when showers occurred for five days.

Winter conditions appeared in 1895 on November 12, and in 1896 on October 20. Frosts west of the Cascades are not, as a rule, injurious after the appearance of summer weather conditions.

Summer conditions are distinguished from winter by the movement of the areas of high and low pressures. In the summer the highs move from off the central California coast northward along the coast to about 50° north latitude, thence eastward. Cool weather appears when the high is between Cape Mendocino and the Columbia River, and it is warmer when the high is moving over the Coast and Cascade ranges. The warmest occurs when the high is to the northeast of Spokane. Under the summer conditions, the low areas retreat to the north and pass eastward about the latitude of Sitka; for this reason, summer rains prevail in Alaska.

CLOUD HEIGHTS—A PROBLEM FOR STUDENTS.

On a preceding page we have published Mr. H. H. Clayton's modification of Feussner's method of computing the height of a cloud by observations of the location of its shadow. This modification consists essentially in applying the double or check computation first extensively introduced by Ekholm and Hagstrom into the so-called parallactic method. The formulæ for the computation are essentially the same as were arranged a year ago by Professor Bigelow for use at the Weather Bureau, in reducing simultaneous cloud observations made at the two ends of a fixed base line.

As the trigonometrical relations are very simple it is to be hoped that many of our intelligent observers will interest themselves in determining frequently the actual heights and motions of the clouds. There are many methods of doing this and these, together with new ones that yet remain to be invented, constitute problems that may well interest every youth when studying trigonometry and its practical applications. Such problems should be explained in our high schools and colleges generally, as an interesting practical example of the use of trigonometry. It is customary for our universities to require special original work from those who are candidates for the higher degrees, such as B. S., M. S., D. S., C. E., A. M., Ph. D., etc. To those candidates who are interested in the atmosphere and terrestrial physics we earnestly recommend the study of the clouds, their altitudes, motions, and laws of formation as a thoroughly appropriate problem and one of the greatest importance to meteorology. The following special deduction of Ekholm's formulæ, as needed in Feussner's method, will interest such students. Nearly all the known methods are enumerated in the Editor's Treatise on Meteorological Apparatus and Methods, Washington, 1887, except that based on the use of the nephoscope at sea, which has been elaborated since then by Finemann and the Editor. Doubtless other methods remain to be invented and we shall be glad to publish them if communicated by our observers.

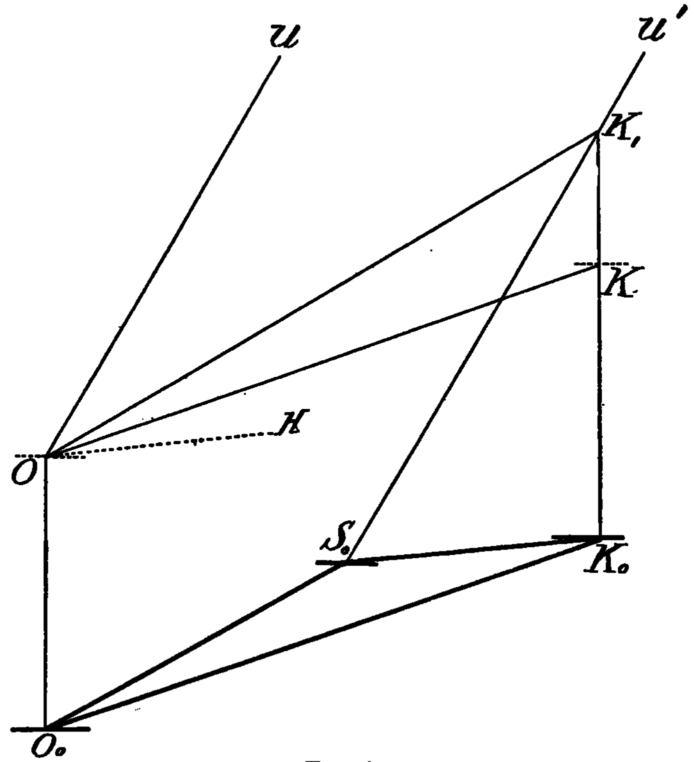

FIG. A.

In Fig. A let O be the observer and O_0 a point below him on the level of the observed shadow of the cloud. Let K_1 be the cloud and S_0 its shadow, the sun being at U or U'. Let K_0 be a point vertically below the cloud and on the same level as S_0. The points O_0, S_0, and K_0 are all on the same lower level and the azimuths, as measured at O, being measured in a horizontal plane, will be the same as the azimuths of these three horizontal lines forming the triangle $S_0O_0K_0$. The azimuths may be measured either from the south point westward or in any other manner most convenient to the observer it matters not which, as only the differences come into consideration at present. The observations are most naturally made in the following order: First, identify the cloud with its shadow and locate the shadow by a mark on the detailed topographical map, as at S_0 in Fig. A and also note the time. The observer at O must then immediately, with his nephoscope, or an equivalent alt-azimuth instrument, observe the apparent altitude of the cloud (or the angle K_1OK or h_1); the azimuth of the cloud (or the azimuth of the line OK or O_0K_0, which is a_1); the apparent altitude of the sun (the angle UOH or $U'S_0K_0$, which is h_2); the apparent azimuth of the sun (which is the azimuth of the line OH, or the parallel line S_0K_0 or a_2). He then determines at his leisure by measurement on the map the azimuth of the cloud shadow (which is the azimuth of the line O_0S_0 or a_3); the distance of the shadow (which is O_0S_0 or b); finally, the difference in level between O and S_0, as shown by the contour lines (which is c or the vertical lines OO_0 or KK_0).

We now have the following simple trigonometrical relations:

$$K_0\,O_0\,S_0 = A_2 = a_3 - a_1$$
$$S_0K_0\,O_0 = A_3 = a_1 - a_2$$
$$O_0\,S_0\,K_0 = A_1 = a_2 - a_3 + 180°$$

Thus all the angles and the side O_0S_0 are known in the triangle $O_0S_0K_0$. The subsequent work consists in computing the other sides O_0K_0 and S_0K_0, which are respectively the bases of two vertical right-angled triangles, in which we know the vertical angles KOK_1 or h_1, and $K_0S_0K_1$ or h_2. With these we now compute both KK_1 or z_1, which is the height of the cloud above the horizontal plane through O and also K_0K_1, which is the height of the cloud above the horizontal plane through O_0. From the latter we subtract the known quantity K_0K or O_0O which leaves KK_1; the latter is, therefore, a second computed value, which should agree with the one just previously computed from the triangle KOK_1. The entire system of formulæ for the solution is as follows:

$$O\,K = O_0\,K_0 = \sin A_1 \frac{b}{\sin A_3}; \quad K K_1 = z_1 = O_0\,K_0 \tan h_1$$

$$S_0K_0 = \sin A_2 \frac{b}{\sin A_3}; \quad K_0K_1 = z_2 = S_0\,K_0 \tan h_2$$

$$z_1 = b \operatorname{cosec} A_3 \tan h_1 \sin A_1$$
$$z_2 - c = b \operatorname{cosec} A_3 \tan h_2 \sin A_2$$
$$z_m = \tfrac{1}{2}\,(z_1 + z_2 - c)$$
$$\Delta z = z_1 - (z_2 - c)$$

If the shadow be watched for a few seconds and located again on the chart or at S_0' then these two locations give directly the direction of motion and the velocity of the shadow, which are the same as for the cloud.

The two values z_1 and $z_2 - c$ evidently ought to agree closely with each other, but for a number of reasons discrepancies are generally present. These arise mostly from the fact that the centre of the cloud as observed from O is not necessarily identical with that portion of the cloud that corresponds to the centre of the shadow. This fact becomes apparent as soon as we consider the very irregular shapes of the clouds. The two centers could only coincide when the cloud is a symmetrical figure. The same would be true if instead of the shadow at S_0 an observer had been stationed there with his theodolite and simultaneous observations had been made without reference to the sun. In general, the lines of sight from O and S_0 will pass through the cloud, but they may pass by each other without intersecting, or they may intersect at some point much nearer or farther than the cloud. In addition to this principal source of discrepancy there are unavoidable errors of pointing and measuring to be considered which may aggravate the error of the assumption just explained. The question therefore recurs which of the computed values of z is to be adopted or what combination of them will give the most probable result. Different students have adopted different rules in this matter, *e. g.*, Ekholm and Hagstrom adopt the location of the center of the shortest line that can be drawn between the two sight lines OK_1 and S_0K_1; that is to say, if these lines do not intersect as they ought to do Ekholm adopts the point of nearest approach to intersection. As this involves much extra computation, Professor Bigelow adopts the simple average of the two computed altitudes. In very accurate measurements, where all sources of error are carefully attended to and where the observed point is very definite as in geodesy, the method of Ekholm and Hagstrom is preferable, but in cloud work, where the observers are almost inevitably sighting upon different points of the same cloud, their method may have no advantage over that of Professor Bigelow. The proper combination of two or more observations so as to determine the most probable height of some definite point within a cloud, and thence the location of the top and bottom points of the cloud, is a question still to be settled.

THE FRANKLIN KITE CLUB.

In the MONTHLY WEATHER REVIEW for 1896, pp. 114, 206, 334, and 416, we have quoted a reference to the Franklin Kite Club at Philadelphia, and its report on the discovery of